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Please find below and/or attached an Office communication concerning this application or proceeding.

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/738,459
Filing Date: December 17, 2003
Appellant(s): TOUR ET AL.

MAILED
SEP 25 2007
GROUP 1700

Victor Behar
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed August 13, 2007 appealing from the Office action mailed March 14, 2007.

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(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner.

I. Claims **1 and 7** are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **WO 01/75903** ('703).

The rejection of claims 1 and 7 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over WO 01/75903 ('703) has been withdrawn in view of Applicants' remarks.

II. Claims **8-9, 11-12 and 18** are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **WO 01/75903** ('703).

The rejection of claims 8-9, 11-12 and 18 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over WO 01/75903 ('703) has been withdrawn in view of Applicants' remarks.

III. Claims **1 and 7** are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **KO 2002-0046342** ('342).

The rejection of claims 1 and 7 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over KO 2002-0046342 ('342) has been withdrawn in view of Applicants' remarks.

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IV. Claims 8, 11-12 and 18 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **KO 2002-0046342** ('342).

The rejection of claims 8, 11-12 and 18 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over KO 2002-0046342 ('342) has been withdrawn in view of Applicants' remarks.

GROUND OF REJECTION NOT ON REVIEW

The following grounds of rejection have not been withdrawn by the examiner, but they are not under review on appeal because they have not been presented for review in the appellant's brief.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a

terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

I. Claims **19-27** are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of copending Application No. **10/764,092** (Tour et al.). Although the conflicting claims are not identical, they are not patentably distinct from each other because the subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that copending application since the referenced copending application and the instant application are claiming common subject matter, as follows:

(a) irradiating carbon nanotubes with microwaves.

The independent claims of the instant application recite similar limitations, either alone or in combination with their dependent claims, as that of the claims of the copending application wherein the claims of the instant application are encompassed by the claims of the copending application. Therefore, the claims would have been obvious variants over each other.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

II. Claims **19-27** are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28 of copending Application No. **10/738,168** (Tour et al.). Although the conflicting claims are

not identical, they are not patentably distinct from each other because the subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that copending application since the referenced copending application and the instant application are claiming common subject matter, as follows:

(a) irradiating carbon nanotubes with microwaves.

The independent claims of the instant application recite similar limitations, either alone or in combination with their dependent claims, as that of the claims of the copending application wherein the claims of the instant application are encompassed by the claims of the copending application. Therefore, the claims would have been obvious variants over each other.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

7,014,737

HARUTYUNYAN ET AL.

3-2006

Fliflet et al., "Application of Microwave Heating to Ceramic Processing: Design and

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Initial Operation of a 2.45-GHz Single-Mode Furnace", IEEE Transactions on Plasma Science, Vol. 24, No. 3 (June 1996) pp. 1041-1049.

Holtzinger et al., "Sidewall Functionalization of Carbon Nanotubes", Angew. Chem. Int. Ed., Vol. 40, No. 21 (2001), pp. 4002-4005.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negated by the manner in which the invention was made.

I. Claims **1-4 and 7** are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Harutyunyan et al.** (US Patent No. 7,014,737 B2).

Harutyunyan teaches a method of crosslinking carbon nanotubes comprising:

(1) providing carbon nanotubes (col. 4, line 64 to col. 5, line 5); and

(2) irradiating said carbon nanotubes with microwaves (= exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation) [col. 7, lines 60-67].

The step of irradiating is carried out in an inert environment selected from the group consisting of ultra-high vacuum, high vacuum, inert gases, and combinations thereof (= the fluid may be a gas or a liquid, including, for example, air, nitrogen, oxygen, argon, helium, hydrochloric acid, nitric acid, and mixtures thereof) [col. 8, lines 21-24].

The microwave radiation comprises a frequency that ranges from about 0.01 GHz to about 100 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The frequency ranges from about 1 GHz to about 18 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The microwave radiation has a power that ranges from about 1 W to about 10,000 W (= 150 W) [col. 7, lines 65-67].

The power ranges from about 10 W to about 1,000 W (= 150 W) [col. 7, lines 65-67].

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose the following:

- a. Yielding a plurality of crosslinked nanotubes, as recited in claim 1.
- b. Wherein the plurality of crosslinked carbon nanotubes comprises at least one junction formed via a rearrangement of carbon atoms, as recited in claim 7.

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because Harutyunyan discloses a method at least in a similar manner as instantly claimed. Therefore, one having ordinary skill in the art would have expected that similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

Furthermore, the method claims are attempting to define subject matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

II. Claims **8-9, 11-15 and 18** are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Harutyunyan et al.** (US Patent No. 7,014,737 B2).

Harutyunyan teaches a method of crosslinking carbon nanotubes comprising:

- (1) providing carbon nanotubes (col. 4, line 64 to col. 5, line 5); and

(2) irradiating said carbon nanotubes with microwaves (= exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation) [col. 7, lines 60-67].

The carbon nanotubes are single-wall carbon nanotubes (col. 4, line 64 to col. 5, line 5).

The step of irradiating is carried out in an inert environment selected from the group consisting of ultra-high vacuum, high vacuum, inert gases, and combinations thereof (= the fluid may be a gas or a liquid, including, for example, air, nitrogen, oxygen, argon, helium, hydrochloric acid, nitric acid, and mixtures thereof) [col. 8, lines 21-24].

The microwave radiation comprises a frequency that ranges from about 0.01 GHz to about 100 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The frequency ranges from about 1 GHz to about 18 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The microwave radiation has a power that ranges from about 1 W to about 10,000 W (= 150 W) [col. 7, lines 65-67].

The power ranges from about 10 W to about 1,000 W (= 150 W) [col. 7, lines 65-67].

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose the following:

- a. Wherein crosslinking is generated between the sidewalls of adjacent carbon nanotubes, as recited in claim 8.
- b. Wherein the crosslinking comprises covalent bonds, as recited in claim 11.
- c. Wherein the covalent bonds are carbon-carbon bonds, as recited in claim 12.

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because Harutyunyan discloses a method at least in a similar manner as instantly claimed. Therefore, one having ordinary skill in the art would have expected that similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

Furthermore, the method claims are attempting to define subject matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

III. Claims **19, 21-24 and 27** are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Harutyunyan et al.** (US Patent No. 7,014,737 B2).

Harutyunyan teaches a method of crosslinking carbon nanotubes comprising:

- (1) providing single-wall carbon nanotubes (col. 4, line 64 to col. 5, line 5); and

(2) irradiating said single-wall carbon nanotubes with microwaves (= exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation) [col. 7, lines 60-67],

wherein the step of irradiating is carried out in an inert environment selected from the group consisting of ultra-high vacuum, high vacuum, inert gases, and combinations thereof (= the fluid may be a gas or a liquid, including, for example, air, nitrogen, oxygen, argon, helium, hydrochloric acid, nitric acid, and mixtures thereof) [col. 8, lines 21-24].

The microwave radiation comprises a frequency that ranges from about 0.01 GHz to about 100 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The frequency ranges from about 1 GHz to about 18 GHz (= 2.45 GHz) [col. 7, lines 65-67].

The microwave radiation has a power that ranges from about 1 W to about 10,000 W (= 150 W) [col. 7, lines 65-67].

The power ranges from about 10 W to about 1,000 W (= 150 W) [col. 7, lines 65-67].

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose the following:

a. Yielding a plurality of crosslinked single-wall carbon nanotubes, as recited in claim 19.

- b. Wherein the crosslinking comprises covalent bonds, as recited in claim 21.
- c. Wherein the covalent bonds are carbon-carbon bonds, as recited in claim 22.
- d. Wherein the plurality of crosslinked single-wall carbon nanotubes comprises at least one junction formed via a rearrangement of carbon atoms, as recited in claim 27.

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because Harutyunyan discloses a method at least in a similar manner as instantly claimed. Therefore, one having ordinary skill in the art would have expected that similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

Furthermore, the method claims are attempting to define subject matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **5 and 6** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Harutyunyan et al.** (US Patent No. 7,014,737 B2) as applied to claims 1-4 and 7 above, and further in view of **Fliflet et al.** ("Application of Microwave Heating to Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace", *IEEE Transactions on Plasma Science*, Vol. 24, No. 3, June 1996, pp. 1041-1049).

Harutyunyan is as applied above and incorporated herein.

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose wherein the microwave radiation is generated by a magnetron, as recited in claim 5.

Harutyunyan teaches a tuned TE₁₀₃ single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial magnetron-based source which can produce up to 6 kW of continuous wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode (pages 1042-1043, "II. Microwave Applicator System").

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

II. Claim **10** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Harutyunyan et al.** (US Patent No. 7,014,737 B2) as applied to claims 8-9, 11-15 and 18 above, and further in view of **Holtzinger et al.** ("Sidewall Functionalization of Carbon Nanotubes", *Angew. Chem. Int. Ed.*, 2001, Vol. 40, No. 21, pp. 4002-4005).

Harutyunyan is as applied above and incorporated herein.

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating, as recited in claim 10.

Harutyunyan teaches that it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed (col. 4, lines 39-42).

Holzinger teaches that chemical derivatization of the nanotubes is desirable to improve their solubility and processibility (page 4002).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the carbon nanotubes described by Harutyunyan with wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating because this would have improved their solubility and processibility as taught by Holtzinger (page 4002).

III. Claims **16 and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Harutyunyan et al.** (US Patent No. 7,014,737 B2) as applied to claims 8-9, 11-15 and 18 above, and further in view of **Fliflet et al.** ("Application of Microwave Heating to

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Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace", *IEEE Transactions on Plasma Science*, Vol. 24, No. 3, June 1996, pp. 1041-1049).

Harutyunyan is as applied above and incorporated herein.

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose wherein the microwave radiation is generated by a magnetron, as recited in claim 16.

Harutyunyan teaches a tuned TE₁₀₃ single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial magnetron-based source which can produce up to 6 kW of continuous wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode (pages 1042-1043, "II. Microwave Applicator System").

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

IV. Claim **20** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Harutyunyan et al.** (US Patent No. 7,014,737 B2) as applied to 19, 21-24 and 27

above, and further in view of **Holtzinger et al.** ("Sidewall Functionalization of Carbon Nanotubes", *Angew. Chem. Int. Ed.*, 2001, Vol. 40, No. 21, pp. 4002-4005).

Harutyunyan is as applied above and incorporated herein.

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating, as recited in claim 20.

Harutyunyan teaches that it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed (col. 4, lines 39-42).

Holzinger teaches that chemical derivatization of the nanotubes is desirable to improve their solubility and processibility (page 4002).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the carbon nanotubes described by Harutyunyan with wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating because this would have improved their solubility and processibility as taught by Holtzinger (page 4002).

V. Claims **25 and 26** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Harutyunyan et al.** (US Patent No. 7,014,737 B2) as applied to claims 19, 21-24 and 27 above, and further in view of **Fliflet et al.** ("Application of Microwave Heating to Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace", *IEEE Transactions on Plasma Science*, Vol. 24, No. 3, June 1996, pp. 1041-1049).

Harutyunyan is as applied above and incorporated herein.

The method of Harutyunyan differs from the instant invention because Harutyunyan does not disclose wherein the microwave radiation is generated by a magnetron, as recited in claim 25.

Harutyunyan teaches a tuned TE₁₀₃ single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial magnetron-based source which can produce up to 6 kW of continuous wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode (pages 1042-1043, "II. Microwave Applicator System").

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a Cober S6F 2.45-GHz industrial magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

(10) Response to Argument

A. Claims 1-4 And 7 Are Not Properly Rejected Under 35 U.S.C. §102(e)/103(a):
Harutyunyan

1. Claim 1

102(e)

Applicants state that Harutyunyan has not (1) supplied microwave radiation to the carbon nanotubes (the radiation is supplied to the metal impurities). For this reason Harutyunyan is not in possession of (2) a plurality of crosslinked nanotubes.

In response, Harutyunyan teaches that:

During the production of nanostructures several impurities form or accumulate around the nanostructures. For example, when single walled carbon nanotubes (SWNTS) are formed, the impurities include residual catalyst, amorphous carbon, and **carbon shells that encase the residual catalyst. Since the shells encase the residual catalyst, it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed** (col. 4, lines 34-42).

To deteriorate the shells, preferably the shells are locally heated, such as by exposure to an electromagnetic field or electromagnetic radiation. In some instances, **the localized heating may be direct**, in other instances, the residual catalyst may be locally heated, which in turn heats the shell since the shell adjacent the catalyst. Optionally, the nanostructures may be cooled by fluid flow during the step of localized heating. In addition, the cooling fluid may be selected to be a fluid that is reactive with the shells to facilitate the deterioration of the shells. For instance, in the case of SWNTs, the cooling fluid may be an oxidizing fluid, such as air, which may oxidize the shells (col. 4, lines 43-54).

In certain embodiments of the invention, the nanotubes comprise carbon nanotubes and the residual particles comprise a metal. In these embodiments, **the localized heating is preferably induced by exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation.** Preferably, the frequency of the microwave radiation is about 2.45 GHz and its power is 150 W (col. 7, lines 60-67).

The microwave radiation would have irradiated the SWNTS because their shells encase the residual catalyst, and in order to remove the residual catalyst, the shells are locally heated by the microwave radiation.

Applicants state that in order to successfully crosslink the carbon nanotubes one must necessarily target the microwave radiation such that the carbon nanotubes absorb

the radiation. Harutyunyan does not target the carbon nanotubes.

In response, Harutyunyan teaches that:

During the production of nanostructures several impurities form or accumulate around the nanostructures. For example, when single walled carbon nanotubes (SWNTS) are formed, the impurities include residual catalyst, amorphous carbon, and **carbon shells that encase the residual catalyst. Since the shells encase the residual catalyst, it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed** (col. 4, lines 34-42).

To deteriorate the shells, preferably the shells are locally heated, such as by exposure to an electromagnetic field or electromagnetic radiation. In some instances, **the localized heating may be direct**, in other instances, the residual catalyst may be locally heated, which in turn heats the shell since the shell adjacent the catalyst. Optionally, the nanostructures may be cooled by fluid flow during the step of localized heating. In addition, the cooling fluid may be selected to be a fluid that is reactive with the shells to facilitate the deterioration of the shells. For instance, in the case of SWNTs, the cooling fluid may be an oxidizing fluid, such as air, which may oxidize the shells (col. 4, lines 43-54).

In certain embodiments of the invention, the nanotubes comprise carbon nanotubes and the residual particles comprise a metal. In these embodiments, **the localized heating is preferably induced by exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation.** Preferably, the frequency of the microwave radiation is about 2.45 GHz and its power is 150 W (col. 7, lines 60-67).

The microwave radiation would have irradiated the SWNTS because their shells encase the residual catalyst, and in order to remove the residual catalyst, the shells are locally heated by the microwave radiation.

The shells are locally heated by the direct exposure to the microwave radiation.

The carbon nanotubes would have absorbed the microwave radiation because a compound and all of its properties are inseparable. *In re Papesch*, 315 F.2d 381, 391, 137 USPQ 43, 51 (CCPA 1963) [MPEP § 2141.02(V)].

Furthermore, if the crude reaction product comprising the carbon nanotubes and the residual catalyst particles was exposed to the microwave radiation, wouldn't the microwave radiation strike some of the carbon nanotubes?

103(a)

Applicants state that Harutyunyan's teachings are directed to the purification of carbon nanotubes. Modification of the Harutyunyan's procedure to crosslink carbon nanotubes would teach away from this very purpose.

In response, Applicants have a different reason for, or advantage resulting from doing what the prior art relied upon has suggested, it is noted that it is well settled that this is not demonstrative of nonobviousness. *In re Kronig* 190 USPQ 425, 428 (CCPA 1976); *In re Linter* 173 USPQ 560 (CCPA 1972); the prior art motivation or advantage may be different than that of Applicants while still supporting a conclusion of obviousness. *In re Wiseman* 201 USPQ 658 (CCPA 1979); *Ex parte Obiaya* 227 USPQ 58 (Bd. of App. 1985) and MPEP § 2144.

Applicants state that the required modification would be to supply microwave radiation to the carbon nanotube rather than the metal impurity. By doing so Harutyunyan would no longer be able to obtain purified nanotubes; *i.e.* he would be destroying them by crosslinking them. The proposed modification cannot change the principle of operation of the prior art being modified, nor can the proposed modification render the prior art unsatisfactory for its intended purpose.

In response, Applicants have a different reason for, or advantage resulting from doing what the prior art relied upon has suggested, it is noted that it is well settled that this is not demonstrative of nonobviousness. *In re Kronig* 190 USPQ 425, 428 (CCPA

1976); *In re Linter* 173 USPQ 560 (CCPA 1972); the prior art motivation or advantage may be different than that of Applicants while still supporting a conclusion of obviousness. *In re Wiseman* 201 USPQ 658 (CCPA 1979); *Ex parte Obiaya* 227 USPQ 58 (Bd. of App. 1985) and MPEP § 2144.

Applicants state that the crosslinking of carbon nanotubes does help define how the irradiation is carried out, and the method of Harutyunyan is not carried out in the same manner. Carrying out the irradiation as taught by Harutyunyan teaches away from crosslinking. Applicant reiterates, carrying out the irradiation in the manner of Harutyunyan is useful for purifying carbon nanotubes.

In response, Harutyunyan teaches:

Exposing a crude reaction product comprising **carbon nanotubes** and residual catalyst particles to **microwave radiation** in **an inert environment** (= **argon, helium**) [col. 8, lines 21-24] wherein the microwave radiation comprises **a frequency of 2.45 GHz** and **a power of 150 W** (col. 7, lines 60-67).

Applicants' procedure is:

Claim 1. A method of crosslinking carbon nanotubes comprising:

- (1) providing **carbon nanotubes**; and
- (2) irradiating said **carbon nanotubes with microwaves** to yield a plurality of crosslinked carbon nanotubes.

Claim 2. The method of claim 1, wherein the step of irradiating is carried out in **an inert environment** selected from the group consisting of ultra-high vacuum, high vacuum, **inert gases**, and combinations thereof.

Claim 3. The method of claim 1, wherein the microwave radiation comprises **a**

frequency that ranges from **about 0.01 GHz to** about 100 GHz.

Claim 4. The method of claim 3, wherein the frequency ranges from **about 1 GHz to** about 18 GHz.

Claim 5. The method of claim 1, wherein the microwave radiation is generated by a magnetron with **a power** that ranges from **about 1 W to** about 10,000 W.

Claim 6. The method of claim 5, wherein the power ranges from **about 10 W to** about 1,000 W.

The method steps disclosed by Harutyunyan are similar to Applicants' method steps. Similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

Why does carrying out the irradiation in the manner of Harutyunyan not yielding a plurality of crosslinked carbon nanotubes? Harutyunyan teaches the same method conditions.

Applicants state that Harutyunyan is useful for purifying carbon nanotubes. Crosslinking nanotubes, by Applicant's procedure, destroys the very operational purpose of Harutyunyan, to isolate purified carbon nanotubes. The proposed modification cannot change the principle of operation of the prior art being modified.

In response, Harutyunyan teaches:

Exposing a crude reaction product comprising **carbon nanotubes** and residual catalyst particles to **microwave radiation** in **an inert environment** (= **argon, helium**)

[col. 8, lines 21-24] wherein the microwave radiation comprises **a frequency of 2.45 GHz** and **a power of 150 W** (col. 7, lines 60-67; and col. 15, claims 1, 3, 4-5).

There is no modification to this operation.

Furthermore, the claims as presently written use the word "comprising". The word "comprising" is inclusive and fails to exclude unrecited steps. *In re Horvitz* 168 F 2d 522, 78 USPQ 79 (CCPA 1948).

Applicants state that no guidance is given to the reader of Harutyunyan that would suggest any modifications or motivation to change the procedure to crosslink nanotubes, by supplying the carbon nanotubes with microwave radiation. Harutyunyan's desire to purify nanotubes teaches away from modifying his procedure as stated above.

In response, Harutyunyan teaches:

Exposing a crude reaction product comprising **carbon nanotubes** and residual catalyst particles to **microwave radiation** in **an inert environment** (= **argon, helium**) [col. 8, lines 21-24] wherein the microwave radiation comprises **a frequency of 2.45 GHz** and **a power of 150 W** (col. 7, lines 60-67; and col. 15, claims 1, 3, 4-5).

There is no modification to Harutyunyan's operation.

Furthermore, the claims as presently written use the word "comprising". The word "comprising" is inclusive and fails to exclude unrecited steps. *In re Horvitz* 168 F 2d 522, 78 USPQ 79 (CCPA 1948).

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Applicants state that the Examiner continues to overlook the limitation of crosslinking of the irradiated carbon nanotubes. This is descriptive of how the microwave radiation is actively interacting with the carbon nanotubes; i.e. irradiation is delivered to the **carbon nanotubes**, not the **metal impurities** as taught by Harutyunyan.

Applicants state that Harutyunyan **does not** irradiate the carbon nanotubes. Harutyunyan irradiates the **metal catalyst impurities**.

In response, Harutyunyan teaches that:

During the production of nanostructures several impurities form or accumulate around the nanostructures. For example, when single walled carbon nanotubes (SWNTS) are formed, the impurities include residual catalyst, amorphous carbon, and **carbon shells that encase the residual catalyst. Since the shells encase the residual catalyst, it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed** (col. 4, lines 34-42).

To deteriorate the shells, preferably the shells are locally heated, such as by exposure to an electromagnetic field or electromagnetic radiation. In some instances, **the localized heating may be direct**, in other instances, the residual catalyst may be locally heated, which in turn heats the shell since the shell adjacent the catalyst. Optionally, the nanostructures may be cooled by fluid flow during the step of localized heating. In addition, the cooling fluid may be selected to be a fluid that is reactive with the shells to facilitate the deterioration of the shells. For instance, in the case of SWNTs, the cooling fluid may be an oxidizing fluid, such as air, which may oxidize the shells (col. 4, lines 43-54).

In certain embodiments of the invention, the nanotubes comprise carbon nanotubes and the residual particles comprise a metal. In these embodiments, **the localized heating is preferably induced by exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation.** Preferably, the frequency of the microwave radiation is about 2.45 GHz and its power is 150 W (col. 7, lines 60-67).

The microwave radiation would have irradiated the SWNTS because their shells encase the residual catalyst, and in order to remove the residual catalyst, the shells are locally heated by the microwave radiation.

The shells are locally heated by the direct exposure to the microwave radiation.

The carbon nanotubes would have absorbed the microwave radiation because a compound and all of its properties are inseparable. *In re Papesch*, 315 F.2d 381, 391, 137 USPQ 43, 51 (CCPA 1963) [MPEP § 2141.02(V)].

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

2-4. Claims 2, 3 and 4

102(e)/103(a)

Claims 2-4 are dependent on claim 1.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

5. Claim 7

102(e)/103(a)

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest crosslinking that includes a junction formed via rearrangement of carbon atoms. The Examiner has failed to cite where Harutyunyan discloses or suggests this. This is because Harutyunyan does not teach any kind of crosslinking. Harutyunyan teaches

irradiating the metal impurities rather than irradiating the carbon nanotubes.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

B. Claims 8-9, 11-15 And 18 Are Not Properly Rejected Under 35 U.S.C.

§102(e)/103 (a): Harutyunyan

1. Claim 8

102(e)

Applicants state that the Examiner further has not pointed to a passage in Harutyunyan that discloses crosslinking between the sidewalls of adjacent carbon nanotubes, as stated in Claim 8.

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In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

Applicants state that Applicants irradiate the carbon nanotubes in order to obtain crosslinking. Harutyunyan does not irradiate the carbon nanotubes.

In response, Harutyunyan teaches that:

During the production of nanostructures several impurities form or accumulate around the nanostructures. For example, when single walled carbon nanotubes (SWNTS) are formed, the impurities include residual catalyst, amorphous carbon, and **carbon shells that encase the residual catalyst. Since the shells encase the residual catalyst, it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed** (col. 4, lines 34-42).

To deteriorate the shells, preferably the shells are locally heated, such as by exposure to an electromagnetic field or electromagnetic radiation. In some instances, **the localized heating may be direct**, in other instances, the residual catalyst may be locally heated, which in turn heats the shell since the shell adjacent the catalyst. Optionally, the nanostructures may be cooled by fluid flow during the step of localized heating. In addition, the cooling fluid may be

selected to be a fluid that is reactive with the shells to facilitate the deterioration of the shells. For instance, in the case of SWNTs, the cooling fluid may be an oxidizing fluid, such as air, which may oxidize the shells (col. 4, lines 43-54).

In certain embodiments of the invention, the nanotubes comprise carbon nanotubes and the residual particles comprise a metal. In these embodiments, **the localized heating is preferably induced by exposing the crude reaction product comprising the carbon nanotubes and the residual catalyst particles to microwave radiation.** Preferably, the frequency of the microwave radiation is about 2.45 GHz and its power is 150 W (col. 7, lines 60-67).

The microwave radiation would have irradiated the SWNTS because their shells encase the residual catalyst, and in order to remove the residual catalyst, the shells are locally heated by the microwave radiation.

103(a)

Applicants state that crosslinking between the sidewalls of adjacent carbon nanotubes further teaches away from the very purpose of Harutyunyan, i.e. to purify carbon nanotubes. Crosslinking would destroy Harutyunyan's purpose of operation.

In response, Applicants have a different reason for, or advantage resulting from doing what the prior art relied upon has suggested, it is noted that it is well settled that this is not demonstrative of nonobviousness. *In re Kronig* 190 USPQ 425, 428 (CCPA 1976); *In re Linter* 173 USPQ 560 (CCPA 1972); the prior art motivation or advantage may be different than that of Applicants while still supporting a conclusion of obviousness. *In re Wiseman* 201 USPQ 658 (CCPA 1979); *Ex parte Obiaya* 227 USPQ 58 (Bd. of App. 1985) and MPEP § 2144.

2. Claim 9

102(e)/103(a)

Claim 9 is dependent on claim 8.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

3. Claim 11

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest the formation of covalent bonds between carbon nanotubes. The Examiner has failed to cite where Harutyunyan discloses or suggests this. This is because Harutyunyan does not teach any kind of covalent bond formation.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

4. Claim 12

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest the formation of covalent carbon-carbon bonds between carbon nanotubes. The Examiner has failed to cite where Harutyunyan discloses or suggests this.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

5-7. Claims 13-15

102(e)/103(a)

Claims 13-15 are dependent on claim 8.

Applicants' remarks have been fully considered but they are not deemed to be

persuasive.

8. Claim 18

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest crosslinking that includes a junction formed via rearrangement of carbon atoms. The Examiner has failed to cite where Harutyunyan discloses or suggests this. This is because Harutyunyan does not teach any kind of crosslinking

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of “to yield a plurality of crosslinked nanotubes” does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

C. Claims 19, 21-24, And 27 Are Not Properly Rejected Under 35 U.S.C.

§102(e)/103(a): Harutyunyan

102(e)

1. Claim 19

The rejection of claim 19 under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Harutyunyan et al. has been maintained for the reasons as discussed above and incorporated herein

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

2. Claim 21

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest the formation of covalent bonds between carbon nanotubes. The Examiner has failed to cite where Harutyunyan discloses or suggests this. This is because Harutyunyan does not teach any kind of covalent bond formation.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

3. Claim 22

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest the formation of covalent carbon-carbon bonds between carbon nanotubes. The Examiner has failed to cite where Harutyunyan discloses or suggests this. This is because Harutyunyan does not teach any kind of covalent bond formation.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any

special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

4-5. Claims 23 and 24

102(e)/103(a)

Claims 23 and 24 are dependent on claim 19.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

6. Claim 27

Applicants state that nowhere does Harutyunyan disclose, teach, or suggest crosslinking that includes a junction formed via rearrangement of carbon atoms. The Examiner has failed to cite where Harutyunyan discloses or suggests this.

In response, there is no requirement that the claim limitation has to be expressly articulated in one or more of the references. The teaching, suggestion or inference can be found not only in the references but also from knowledge generally available to one of ordinary skill in the art. *Ashland Oil v. Delta Resins* 227 USPQ 657 (CAFC 1985). References are evaluated by what they collectively suggest to one versed in the art, rather than by their specific disclosures. *In re Simon* 174 USPQ 114 (CCPA 1972); *In re Richman* 165 USPQ 509, 514 (CCPA 1970).

How the microwave radiation is actively interacting with the carbon nanotubes

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would have been inherent from performing the method (steps) because the present claim limitation of "to yield a plurality of crosslinked nanotubes" does not point out any special or critical circumstance or method condition that distinguishes the claimed method from the prior art.

D. Claims 5 And 6 Are Not Properly Rejected Under 35 U.S.C. §103(a): No.

Harutyunyan in view of Fliflet

Applicants state that the Examiner states that it would have been obvious replace the 1.5 kW/2.45 GHz power supply of the tuned TE₁₀₃ single mode cavity with Fliflet's NRL 2.45 GHz microwave furnace. Absent the Applicant's disclosure there is absolutely no reason to make such a substitution. The Examiner must find the motivation to make such a change in the references cited. The Examiner has merely used the Applicant's disclosure as a road map for hindsight reconstruction to suggest changing the microwave source.

In response, Fliflet is used only for the teaching of a magnetron.

Harutyunyan teaches a tuned TE₁₀₃ single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial **magnetron-based source** which can produce up to 6 kW of continuous wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode

(pages 1042-1043, "II. Microwave Applicator System").

The Examiner maintains that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a Cober S6F 2.45-GHz industrial magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

E. Claim 10 Is Not Properly Rejected Under 35 U.S.C. §103(a): Harutyunyan in view of Holtzinger

Applicants state that one could replace the unfunctionalized nanotubes of Harutyunyan with the functionalized nanotubes of Holtzinger, but what is the motivation to make such a replacement?

In response, Harutyunyan teaches that it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed (col. 4, lines 39-42).

Holzinger teaches that chemical derivatization of the nanotubes is desirable to improve their solubility and processibility (page 4002).

The Examiner maintains that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the carbon nanotubes described by Harutyunyan with wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating because this would have improved their solubility and processibility as taught by Holtzinger (page 4002).

The reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

F. Claims 16 And 17 Are Not Properly Rejected Under 35 U.S.C. §103(a):

Harutyunyan in view of Fliflet

Applicants state that the Examiner states that it would have been obvious replace the 1.5 kW/2.45 GHz power supply of the tuned TE103 single mode cavity with Fliflet's NRL 2.45 GHz microwave furnace. Absent the Applicant's disclosure there is absolutely

no reason to make such a substitution. The Examiner must find the motivation to make such a change in the references cited. The Examiner has merely used the Applicant's disclosure as a road map for hindsight reconstruction to suggest changing the microwave source.

In response, Fliflet is used only for the teaching of a magnetron.

Harutyunyan teaches a tuned TE₁₀₃ single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial **magnetron-based source** which can produce up to 6 kW of continuous wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode (pages 1042-1043, "II. Microwave Applicator System").

The Examiner maintains that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a Cober S6F 2.45-GHz industrial magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon

hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

G. Claim 20 Is Not Properly Rejected Under 35 U.S.C. §103(a): Harutyunyan in view of Holtzinger

Applicants state that one could replace the unfunctionalized nanotubes of Harutyunyan with the functionalized nanotubes of Holtzinger, but what is the motivation to make such a replacement?

In response, Harutyunyan teaches that it is desirable to remove or deteriorate the shells so that the residual catalyst can be more readily removed (col. 4, lines 39-42).

Holzinger teaches that chemical derivatization of the nanotubes is desirable to improve their solubility and processibility (page 4002).

The Examiner maintains that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the carbon nanotubes described by Harutyunyan with wherein the carbon nanotubes are chemically functionalized prior to the step of irradiating because this would have improved their solubility and processibility as taught by Holtzinger (page 4002).

The reason or motivation to modify the reference may often suggest what the

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inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

H. Claims 25 and 26 Are Not Properly Rejected Under 35 U.S.C. §102(b)/103(a):

Harutyunyan in view of Fliflet

Applicants state that the Examiner states that it would have been obvious replace the 1.5 kW/2.45 GHz power supply of the tuned TE103 single mode cavity with Fliflet's NRL 2.45 GHz microwave furnace. Absent the Applicant's disclosure there is absolutely no reason to make such a substitution. The Examiner must find the motivation to make such a change in the references cited. The Examiner has merely used the Applicant's disclosure as a road map for hindsight reconstruction to suggest changing the microwave source.

In response, Fliflet is used only for the teaching of a magnetron.

Harutyunyan teaches a tuned TE103 single mode cavity driven by a 1.5 kW, 2.45 GHz power supply (col. 11, lines 41-45).

Like Harutyunyan, Fliflet teaches microwave heating. Fliflet teaches a NRL 2.45-GHz microwave furnace system wherein the microwave source is a Cober S6F 2.45-GHz industrial **magnetron-based source** which can produce up to 6 kW of continuous

wave (CW) power and the microwave cavity is a TE₁₀₃ rectangular wave guide mode (pages 1042-1043, "II. Microwave Applicator System").

The Examiner maintains that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the microwave radiation described by Harutyunyan with wherein the microwave radiation is generated by a magnetron because a Cober S6F 2.45-GHz industrial magnetron-based source would have produced 1.5 kW and 2.45 GHz of power as taught by Fliflet (pages 1042-1043, "II. Microwave Applicator System").

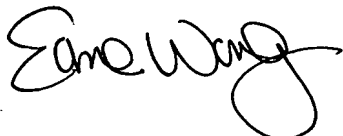
In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

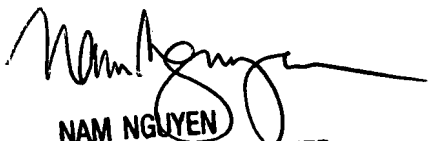
For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,



Edna Wong

Conferees:



NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Nam Nguyen

/Kathryn Gorgos/

Kathryn Gorgos

Appeal Conferee